

Conference Programme

Sunday 26 September 2010

Arrival & Registration

(16h00 – 18:00) [DICKIE DAGGE HALL]

Welcome Reception

(18:00) [DICKIE DAGGE HALL]

Monday 27 September 2010

(08:00 – 08:30)

Registration

[DICKIE DAGGE HALL]

Monday 27 September 2010: (08:30 -10:00)

Plenary Session I: Conference Opening

[Dickie Dagge Hall]

Chair: Hans Ittman

08:30 – 08:45	Prof MM Sibara (Deputy Vice Chancellor , UL) <i>Welcome address</i>
08:45 – 09:00	‘Maseka Lesaoana (ORSSA 2010 Conference Chair) <i>Announcements</i>
09:00 – 09:15	Pali Lehohla (Statistician General: Statistics South Africa)
09:15 – 09:30	Dave Evans (ORSSA President) <i>Presidential Address</i>
09:30 – 10:30	James Cochran (Keynote Speaker)

Tea/Coffee (10:30 – 11:00) [Dickie Dagge Hall Foyer]

Monday 27 September 2010 (10:30 – 12:30)

Parallel Session I: Inventory Management

[Dickie Dagge Hall]

Chair: Tanya Lane

11:00 – 11:30	Wilna Bean , <i>Inventory management under uncertainty – An application.</i>
11:30 – 12:00	Simbarashe M Mubaira , <i>Analysis of inventory using economic order quantity model for fuel company in Zimbabwe</i>
12:00 – 12:30	Kelvin Chirenje , <i>Determining a mathematical model for inventory planning and control for Inncor Africa(Zimbabwe)</i>

Parallel Session II: Decision Support Systems and Military Applications

[King Makgoba's Room]

Chair: Philimon Nyamugure

11:00 – 11:30	Jacques du Toit , <i>Coastal threat evaluation decision support</i>
11:30 – 12:00	Neil M Watson , <i>Aiding decision making in allocation at FoodbankSA</i>
12:00 – 12:30	Winnie C Pelser , <i>Tools & methodology for high level military decision analysis</i>

Lunch (12:30 – 13:30) [Dining Hall]

Monday 27 September 2010 (13:30 – 15:00)

Plenary Session II: Presentation by Hylton Robinson,

Marlize Meyer and Michele Fisher from Sasol

[Dickie Dagge Hall]

Chair: Daniel Maposa

13:30 – 13:35	Hans Ittman , <i>Introduction</i>
13:35 – 14:15	Hylton Robinson, Marlize Meyer and Michele Fisher <i>Franz Edelman Awards - a reprise from Sasol, the first South-African Finalist in 15 years</i>
14:15 – 15:00	Audience , <i>Floor discussion</i>

Tea/Coffee (15:00 – 15:30) [Dickie Dagge Hall Foyer]

Monday 27 September 2010 (15:30 – 17:30)

Parallel Session III: Transportation Science & Urban Transportation
[Dickie Dagge Hall]

Chair: Tumo Baitshenyetsi

15:30 – 16:00	Brian J. M. Chiripanhura , <i>Vehicle routing and scheduling optimisation system for the beverage industry in Zimbabwe</i>
16:00 – 16:30	Mark D Einhorn , <i>An evaluation of the efficiency of self-organising versus fixed traffic signalling paradigms</i>
16:30 – 17:00	Elias J Willemse , <i>Scalable solutions in OR: An application in waste collection and transportation</i>
17:00 – 17:30	Wouter H Bothma , <i>Residential waste management in South Africa: Optimisation of vehicle fleet size and composition.</i>

Parallel Session IV: Combinatorial Optimization
[King Makgoba's Room]

Chair: Marthi Harmse

15:30 – 16:00	Martijn van der Merwe , <i>Games on Networks</i>
16:00 – 16:30	Moses Dowart , <i>A Lagrangian relaxation for parallel machines with precedence constraints</i>
16:30 – 17:00	Edward T Chiyaka , <i>Application of graph theory in matching problems</i>
17:00 – 17:30	Victoria G Mabe-Madisa , <i>Decision tree analysis for the risk averse organization</i>

Braai/Social Evening (18:00 onwards)
[Dickie Dagge Hall]

Tuesday 28 September 2010

Tuesday 28 September 2010: (08:30 – 10:30)

Parallel Session V: General Papers

[Dickie Dagge Hall]

Chair: Ozias Ncube

08:30 – 09:00	Tshepang F Chueu , <i>Analysis of the common causes of human deaths in Limpopo Province</i>
09:00 – 09:30	Rendani A Nenzhelele , <i>A comparison of Grade 12 pass rates between the old and the new curriculum in Limpopo</i>
09:30 – 10:00	Sipho J Riba , <i>A logistic regression analysis of the occurrence of mine accidents in the Burgersfort area in South Africa</i>
10:00 – 10:30	Happy Maluleke , <i>An analysis of number of the vehicles and pedestrian involved in fatal crashes: Limpopo Province, South Africa</i>

Parallel Session VI: Logistics, Warehousing & Distribution

King Makgoba's Room

Chair: Edward Chiyaka

08:30 – 09:00	Ian Campbell , <i>Packaging cost optimization for an electric part distributor in South Africa</i>
09:00 – 09:30	Tumo Baitshenyetsi , <i>Applying a tree knapsack approach to general network design: a case study</i>
09:30 – 10:00	Ernest J Lanz , <i>Facility location for FoodBank Cape Town</i>
10:00 – 10:30	Estelle van Wyk , <i>A generic inventory model for disaster relief</i>

Tea/Coffee (10:30 – 11:00) [Dickie Dagge Hall Foyer]

Tuesday 28 September 2010: (11:00 – 12:30)

Parallel Session VII: Supply Chain Management and Optimisation

[Dickie Dagge Hall]

Chair: Caston Sigauke

11:00 – 11:30	Ozias Ncube , <i>Modelling supply chain risks in agile supply chains</i>
11:30 – 12:00	Anton P de Villiers & Stephan E Visagie , <i>Directed cyclical picking line optimization - Part I: Industry background and introduction</i>
12:00 – 12:30	Jason Matthews , <i>Directed cyclical picking line optimization Part II: Algorithms, preliminary results and future work</i>

Parallel Session VIII: Communications & Information Technology
[King Makgoba's Room]

Chair: Kolentino Mpeta

11:00 – 11:30	Darian N Raad , <i>PLATFORMS: An online platform for the practice and theory of operations research / management science</i>
11:30 – 12:00	David C. Zvipore , <i>Network optimization techniques</i>
12:00 – 12:30	Hildah Mashira , <i>Operations research in transportation of goods and services</i>

Lunch (12:30 – 13:30) [Dining Hall]

Tuesday 28 September 2010 (13:30 – 16:00)

Parallel Session IX: Equity, Poverty Alleviation & Humanitarian OR
[Dickie Dagge Hall]

Chair: Mokowe Makwela

13:30 – 14:00	Wilna du Plessis , <i>Improved assignment and routing of care workers for the home and community-based care scenario in South Africa</i>
14:00 – 14:30	Alexandra S Ndiwalana , <i>Communicable disease disaster management</i>
14:30 – 15:00	Hans W Ittmann , <i>Experiences in using operations research for development</i>
15:00 – 15:30	Rampedi L Mothapo , <i>Analysis of poverty in South Africa</i>
15:30 – 16:00	Abigail D Manakana , <i>The effect of unemployment on crime among young South Africans</i>

Parallel Session X: Forecasting & OR Applications in the Energy Sector
[King Makgoba's Room]

Chair: Hausitoe Nare

13:30 – 14:00	Bernard Schlunz , <i>Decision support with respect to generator maintenance scheduling in the energy sector</i>
14:00 – 14:30	Collen Hlungwani , <i>Forecasting monthly production of gold in South Africa</i>
14:30 – 15:00	Tanya E Lane , <i>Operations research: A cornerstone for freight transport energy management</i>
15:00 – 15:30	Phineas Rapholo , <i>The effect of high electricity consumption on the South African economy</i>
15:30 – 16:00	Ian Shendelana , <i>Analysis of the inflation rate of alcoholic beverages</i>

Tea/Coffee (16:00 – 16:30) [Dickie Dagge Hall Foyer]

Tuesday 28 September 2010: (16:30 – 18:00)

ORSSA Annual General Meeting

Chair: Dave Evans (ORSSA President) [King Makgoba's Room]

Dinner (19:00 onwards) [Dickie Dagge Hall]

Wednesday 29 September 2010

Wednesday 29 September 2010

Parallel Session XI: Forecasting & OR Applications in the Energy Sector
[Dickie Dagge Hall]

Chair: Jacques du Toit

08:30 – 09:00	Ian N Durbach , <i>Decision support for evaluating electricity saving options</i>
09:00 – 09:30	Caston Sigauke , <i>Daily peak electricity load forecasting in South Africa using a multivariate non-parametric regression approach</i>
09:30 – 10:00	Matlou M Moabelo , <i>Electricity generated and available for distribution in South Africa</i>
10:00 – 10:30	Hausitoe Nare , <i>A method of detection and correction for outliers in time series data.</i>
10:30 – 11:00	Ntiyiso Makukule , <i>Daily electricity demand forecasting in South Africa</i>

Parallel Session XII:

OR in Business, Industry & Agriculture [King Makgoba's Room]

Chair: Martin P Kidd

08:30 – 09:00	Kolentino N Mpeta , <i>Marketing operations research</i>
09:00 – 09:30	Me Linke Potgieter , <i>A mathematical model for the control of <i>Eldana Saccharina</i> Walker</i>
09:30 – 10:00	Daniel Maposa , <i>Investigating the effects of different grazing ratios and stocking rate of cattle and goats under mixed species grazing on different plant species</i>
10:00 – 10:30	Philimon Nyamugure , <i>A holistic application of process capability indices</i>
10:30 – 11:00	Marthi Harmse , <i>Diagnostic analysis of a Saturday school</i>

Tea/Coffee (11:00 – 11:30) [Dickie Dagge Hall Foyer]

Parallel Session XIII: Heuristics, Metaheuristics & Hyperheuristics

[The Bridge Room]

Chair: Ian Durbach

08:30 – 09:00	Jonas Stray , <i>Tactical Sugarcane Harvest Scheduling</i>
09:00 – 09:30	Tjaart T Steyn , <i>Finding the optimal cutting patterns for N identical two-dimensional stock sheets</i>
09:30 – 10:00	Sanele SM Manyatsi , <i>Investigating some heuristic solutions for the two-dimensional cutting stock problem</i>
10:00 – 10:30	Tichaona C Mazuru , <i>Optimisation of inventory using a probabilistic method</i>
10:30 – 11:00	Martin P Kidd , <i>A tabu-search for minimising the carry-over effects value of a round-robin tournament</i>

Wednesday 29 September 2010: (11:30 – 1300)

Plenary Session III: Conference Closing

[Dickie Dagge Hall]

Chair: Dave Evans (ORSSA President)

11:30 – 12:30	Sarma Yadavalli: A reflection on papers read at the conference
12:30 – 13:00	Final announcements and good bye

Lunch (13:00 – 14:00) [Dining Hall]

Depart 14:00

List of Papers

(1) <i>Determining a mathematical model for inventory planning and control for Innskor Africa (Zimbabwe) (Kelvin Chirenje)</i>	16
(2) <i>Daily peak electricity load forecasting in South Africa using a multivariate non-parametric regression approach (Caston Sigauke)</i>	17
(3) <i>PLATFORMS: An online platform for the practice and theory of operations research / management science (Darian N Raad)</i>	18
(4) <i>A generic inventory model for disaster relief (Estelle van Wyk)</i>	19
(5) <i>Packaging cost optimization for an electric part distributor in South Africa (Ian Campbell)</i>	20
(6) <i>Optimisation of inventory using a probabilistic method (Tichaona C Mazuru)</i>	21
(7) <i>A Lagrangian relaxation for parallel machines with precedence constraints (Moses Dowart)</i>	22
(8) <i>A holistic application of process capability indices (Philimon Nyamugure)</i>	23
(9) <i>Network optimization techniques (David C Zvipore)</i>	24
(10) <i>Marketing operations research (Kolentino N Mpeta)</i>	25
(11) <i>Experiences in using operations research for development (Hans W Ittmann)</i>	26
(12) <i>Applying a tree knapsack approach to general network design: a case study (Tumo Baitshenyetsi)</i>	27
(13) <i>Decision support with respect to generator maintenance scheduling in the energy sector (Bernard Schlunz)</i>	28
(14) <i>Vehicle routing and scheduling optimisation system for the beverage industry in Zimbabwe (Brian J M Chiripanhura)</i>	29
(15) <i>Analysis of inventory using economic order quantity model for fuel company in Zimbabwe (Simbarashe M Mubaira)</i>	30
(16) <i>Improved assignment and routing of care workers for the home and community-based care scenario in South Africa (Wilna du Plessi)</i>	31
(17) <i>An evaluation of the efficiency of self-organising versus fixed traffic signalling paradigms (Mark D Einhorn)</i>	32
(18) <i>A mathematical model for the control of Eldana Saccharina Walker (Me Linke Potgieter)</i>	33

(19) Coastal threat evaluation decision support (Jacques du Toit).....	34
(20) Communicable disease disaster management (Alexandra S Ndiwalana).....	35
(21) Aiding decision making in allocation at FoodbankSA (Neil M Watson).....	36
(22) Application of graph theory in matching problems (Edward T Chiyaka).....	37
(23) Games on Networks (Martijn van der Merwe).....	38
(24) Operations research: a cornerstone for freight transport energy management (Tanya E Lane).....	39
(25) Decision support for evaluating electricity saving options (Ian N Durbach).....	40
(26) Finding the optimal cutting patterns for N identical two-dimensional stock sheets (Tjaart T Steyn).....	41
(27) Investigating some heuristic solutions for the two-dimensional cutting stock problem (Sanele SM Manyatsi).....	42
(28) A method of detection and correction for outliers in time series data.(Hausitoe Nare).....	43
(29) Investigating the effects of different grazing ratios and stocking rate of cattle and goats under mixed species grazing on different plant species (Daniel Maposa).....	44
(30) Facility location for FoodBank Cape Town (Ernest J Lanz).....	45
(31) Tools & methodology for high level military decision analysis (Winnie C Pelsler).....	46
(32) Scalable solutions in OR: An application in waste collection and transportation (Elias J Willemse).....	47
(33) Modelling supply chain risks in agile supply chains (Ozias Ncube).....	48
(34) Residential waste management in South Africa: Optimisation of vehicle fleet size and composition (Wouter H Bothma).....	49
(35) Directed cyclical picking line optimization Part II: Algorithms, preliminary results and future work (Jason Matthews).....	50
(36) A tabu-search for minimizing the carry-over effects value of a round-robin tournament (Martin P Kidd).....	51
(37) Inventory management under uncertainty – An application. (Wilna Bean).....	52
(38) Directed cyclical picking line optimization - Part I: Industry background and introduction (Anton P de Villiers).....	53
(39) Daily electricity demand forecasting in South Africa (Ntiyiso Makukule).....	54

(40) Analysis of the common causes of human deaths in Limpopo Province (Tshepang F Chueu).....	55
(41) The effect of unemployment on crime among young South Africans (Abigail D Manakana).....	56
(42) Electricity generated and available for distribution in South Africa (Matlou M Moabelo).....	57
(43) A comparison of Grade 12 pass rates between the old and the new curriculum in Limpopo (Rendani A Nenzhelele).....	58
(44) Analysis of the inflation rate of alcoholic beverages (Ian Shendelana).....	59
(45) The effect of high electricity consumption on the South African economy (Phineas Rapholo).....	60
(46) Analysis of poverty in South Africa (Rampedi L Mothapo).....	61
(47) A logistic regression analysis of the occurrence of mine accidents in the Burgersfort area in South Africa (Sipho J Riba).....	62
(48) Forecasting monthly production of gold in South Africa (Collen Hlungwani).....	63
(49) An analysis of number of the vehicles and pedestrian involved in fatal crashes: Limpopo province, South Africa (Happy Maluleke).....	64
(50) Diagnostic analysis of a Saturday school (Marthi Harmse)	65
(51) Income tax prediction when tax avoidance matter (Victoria G Mabe-Madisa).....	66
(52) Tactical sugarcane harvest scheduling (Jonas Stray).....	67
(53) Operations research in Transportation of goods and services (Hildah Mashira).....	68

List of Authors

Shabbir Ali (Wits University, South Africa)
Tumo Baitshenyetsi (North-West University, South Africa)
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Wilna du Plessis (University of Pretoria, South Africa)
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Alexandra S Ndiwalana (University of Pretoria, South Africa)
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David C Zvipore (National University of Science and Technology, Zimbabwe)
VSS Yadavalli (University of Pretoria, South Africa)

Invited Paper Abstracts

1. Opening Plenary Session

From Pretzel Rods to Frankenstein for President to Taxi Wars: One Odd OR Odyssey and Lessons for Africa

James Cochran

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Abstract

How does one go from designing pretzel rods to creating a presidential candidate to resolving a taxi war? And what lessons for application of operations research in Africa can be learned from these experiences? These seemingly disparate problems are linked by two common factors - each problem can be addressed by application of operations research, and each problem in succession represents a surprising extension of the previous problem. In this talk Professor Cochran will provide an overview of each of these problems and how they are connected. He will also discuss some of the surprising lessons he has learned through his experiences working on applied statistics and operations research projects in other cultures, and he will explain how this led him to conclude that a slight perturbation of Pascal's triangle is a key to spreading successful applications of operations research throughout Africa.

2. Second Plenary Session

Franz Edelman Awards - a reprise from Sasol, the first South-African Finalist in 15 years

Hylton Robinson
Sasol

Marlize Meyer
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Michele Fisher
Sasol

Abstract

Sasol was honoured to be chosen as a finalist in the prestigious international Edelman Awards which are sponsored by the Institute for Operations Research and the Management Sciences (INFORMS®). The purpose of the Edelman competition is to bring forward, recognise and reward outstanding examples of management science and operations research practice in the world. Each year they recognise Operations Research work that has been implemented, sustained and proven to give a high benefit to industry big-wigs such as Proctor&Gamble, Hewlett-Packard, Netherlands Railways and IBM.

The Sasol Technology competition entry was based on the development of a suite of stochastic simulation models which are able to reflect the production variability over time better than any of the standard average based techniques currently available. This work is an exceptional application of discrete event simulation to Sasol's unique coal-to-liquids value chain. As such it is a world first.

The Edelman awards are the "Oscars" of the Operations Research discipline and Sasol's nomination acknowledges that work done by the group is world class. Although the team did not walk away with the final award, the accolades that poured in from the international arena were overwhelming. The nomination of Sasol as an Edelman finalist and hence Academy and Laureate member has secured international Operations Research community recognition. It has ensured the company's place amongst industry leaders. This will have major value into the future as we expand our Operations Research function in the company.

Contributed Paper Abstracts

Determining a mathematical model for inventory planning and control for Inncor Africa (Zimbabwe)

Kelvin Chirenje
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Abstract

The study mainly focuses in coming up with a mathematical inventory planning and control model that will trim down shortages in a probabilistic demand situation for Inncor Africa fast foods division in Borrowdale, Zimbabwe. Five major raw materials were selected and their respective safety stocks and re-order levels calculated. Exponential smoothing techniques will be used to determine the model with low forecasting errors. A combination of the established safety stocks, re-order points and the forecasting technique will form the model for Inventory Planning and Control.

Keywords: Production and Inventory Control, Forecasting Models.

Daily peak electricity load forecasting in South Africa using a multivariate non-parametric regression approach

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Abstract

The paper presents multivariate adaptive regression splines (MARS) modelling approach for daily peak electricity load forecasting in South Africa for the period 2000 to 2009. MARS is a non-parametric multivariate regression method which is used to solve high dimensional problems with complex model structures such as nonlinearities, interactions and missing data in a straight forward manner and produces models which can be explained to management. The developed model consists of components that represent calendar and meteorological data. The performance of the model is evaluated by comparing it with a piecewise linear regression model. The MARS model outperformed the piecewise linear regression model. Accurate prediction of daily peak load demand is very important for decision makers in the energy sector. This helps in the determination of consistent and reliable supply schedules during peak periods. Accurate short term load forecasts will enable effective load shifting between transmission substations, scheduling of startup times of peak stations, load flow analysis and power system security studies.

Key words: MARS, temperature, peak demand forecasting, piecewise linear regression.

Platforms: An online platform for the practice and theory of operations research / management science

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Abstract

In this talk I will be discussing a generic online software platform for the rapid development, testing and implementation of optimization algorithms over a wide variety of problem categories. This forms part of a broader vision to create an online platform of platforms offering OR and collaboration software and services to industry, government and academia, also functioning as a resource and rallying point for OR best practice. I will illustrate the idea behind PLATFORMS by telling the story of a young OR practitioner. Anthony B is an OR graduate who wants to create and sell an online supply chain management program. First he will create an account on the PLATFORMS website. He will research the topic using Ormsyclopaedia, a specialized wiki maintained by the community, which also provides assessments of the necessary vehicle routing and assignment algorithms. He will build the application primarily using the standardised components available in The Laboratory, a high-level integrated development environment (including web designer, source code editor, debugger, interpreter) for algorithm, application and interface development, which provides access to a host of prebuilt components and software libraries and integrates with real-time data-sources such as Google Maps. He will test his program using relevant standardised problem instances from the OR Infobase. Once the application is completed, he will sell access to it via The Marketplace. By default, PLATFORMS applications are geared towards multi-user access, facilitating cross-organisation collaboration and optimization. I will review existing open-source software projects and web-tools (such as CoinOR and Google Web Toolkit) to evaluate whether PLATFORMS could be realized using existing frameworks, or whether it would be better to develop it from scratch. A system like PLATFORMS has the potential to modernize OR research and improve the ease-of-use and accessibility of OR tools, ultimately allowing more widespread use in practice.

A generic inventory model for disaster relief

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Abstract

Not much can be done to prevent the occurrence of a disaster, but one can be prepared in the event of a disaster. Pre-positioning of aid supplies has become a crucial part of disaster management, providing the possibility to overcome the impact of a disaster and reduce the suffering and loss of life associated with disaster events. Natural and man-made disasters are extremely unpredictable, therefore disasters need to be researched and their impact fully understood so that the aid supplies required to survive disaster events can be available. The member states within the Southern African Development Community (SADC) are the countries of interest for this paper, as research conducted on inventory pre-positioning for disaster response in these countries has been insufficient. There is a need to satisfy the demands of disaster victims for any relevant disaster. This need is measured by the types and amounts of aid supplies required by disaster victims. All the man-made and natural disasters that have occurred in these countries over the last 30 years are identified, as well as all the relevant aid supplies required to survive these disasters. General research contributions applied to humanitarian operations have increased significantly, whilst operations research methods have not yet been comprehensively introduced to solve disaster related problems. A literature review examines the problems associated with the disaster management preparedness phase and the existing models used to solve these problems. This paper proposes a generic mathematical model that can be used to effectively determine the types and amount of aid supplies required in pre-positioning facilities within SADC to enhance the survival capability of people in SADC directly after the occurrence of any of the disasters identified. Finally, a sensitivity analysis is performed, using various case studies of SADC countries, to illustrate the functionality of the model.

Packaging cost optimization for an electric part distributor in South Africa

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Shabbir Ali
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Abstract

Product packaging affects both the product cost and logistics costs. Packaging affects the size of the product and hence affects the quantity that can be packed on a pallet. This in turn affects shipping and storage costs. More packaging also raises the carbon footprint of a delivered product. The type of packaging used is chosen by considering the size and weight of the product, level of damage protection required, as well as presentation aesthetics relating to consumer perception and behaviour. A model was developed to optimize the total cost of packaging for products for an electrical part wholesale distributor in South Africa. Parts are sourced from the overseas parent company and distributed via a warehouse in South Africa to wholesale customers. The cost of the materials, inbound logistics, storage, outbound logistics and carbon footprint were included.

Optimization of inventory using a probabilistic method

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Abstract

This paper looks at how inventory costs for the manufacture of fresh bread by a local company can be minimized taking into consideration that demand is uncertain. In this paper, we want to find out how probabilistic models of inventory management can be used to determine bread level suitable for a company to make profit. We are to determine optimal order quantities and reorder points under demand and lead time uncertain. Results from this study suggest that by analyzing a time series of demand a realization will be obtained were a constant probability value can be found which maintain a varying production level

A Lagrangian relaxation for parallel machines with precedence constraints

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Abstract

The Lagrangian Relaxation is a generalization of the use of lagrangian multipliers in solving constrained optimization problems. A parallel machine system is a generalization of the single machine model. In a parallel machine environment we have several machines that can process a job. We present the scheduling of independent jobs with due dates on identical, parallel machines. The jobs have different levels of importance and the operations of a job must be undertaken in a particular order (precedence constraints or process plans). The objective is to minimize the weighted quadratic job tardiness

Key words and phrases: Lagrangian Relaxation, Precedence Constraints, Parallel Machines, weighted quadratic tardiness.

A holistic application of process capability indices

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Abstract

So many different capability measuring techniques have been proposed and are being used in industry today. Each one gives a certain portion of the quality picture, leaving out some equally important details about the process. There is no one index which address the whole quality of a production process on its own so there is need to look at all the indices holistically. Each index has its own merits and demerits. A certain company which manufactures belts has been using only one index Cpk and its quality checks were indicating that the process was in control. On the other hand customers have been complaining that the belts they are manufacturing are not strong and tend to breaking easily. This paper concentrates on addressing the production process of belts by looking at different capability indices and come up with a method or algorithm that addresses this problem holistically. Strengths and weaknesses of each capability index were analyzed and sets of indices which address the full picture of the production process were used to check the capability of the process. It was found out that customers were justified in their complains as the new quality checks indicated that the production process of these belts was incapable of producing belts which meet customer satisfaction. Corrective measures were recommended to the company.

Network optimization techniques

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Abstract

In this study, we aim to optimize the Global System for Mobile Communication (GSM) transmission capacity and the system operational efficiency, through the application of the Maximal-flow algorithm. The objective of this model being to determine the maximum content that can be transmitted simultaneously between the source and the sink nodes in the Interfaces and Protocols that exist within the basic GSM subsystems and the various functional entities and the resultant effects of the power control parameters. This enhances the need for power control mechanism so as to ensure good communication quality of ongoing calls and improves network efficiency.

Marketing operations research

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Abstract

For most people in developing countries, managers included, Operations Research or Management Science are foreign phrases to them. Quantitative Methods seems more common and even then it is considered as one of those subjects with a lot of mathematical calculations. There is therefore need to aggressively and purposively market Operations research especially in Africa. Operations research is a very useful and powerful tool that can play a very important role in the development of Africa and unless and until the stakeholders: government officials, CEOs, Managing Directors and Managers in industry and commerce are aware and at least know what Operations Research can do for their countries or organizations Africa may continually lag behind in development matters.

Experiences in using operations research for development

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Abstract

There are many opportunities to use Operations Research in a developing context. This is not very different from the traditional areas of use of OR. However there are differences and Operations Researchers needs to be sensitive too these differences. This paper will cover three case studies in South Africa where the Operations Research approach was used to address problems in a development context. The first case study will describe a simulation model that was developed to simulate a “sustainable village”. The idea was to establish various activities in a village in such a way that it would ensure the long term sustainability of the village. The second case study addresses the issue of rural logistics or small business logistics. This is an area that has been neglected but it requires serious attention. Not only will this stimulate the establishment of small businesses but it will create many jobs in the process. The third case study outlines the assistance provided to a non-governmental organisation that is responsible for thousands of HIV/Aids orphans. Finally experiences from these three case studies that Operations Researchers should be aware of, will be shared.

Applying a tree knapsack approach to general network design: a case study

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Abstract

There are a huge number of practical decision problems that fall into the category of network flow problems and many examples of applications can be found in areas such as logistics, distribution, engineering, computer science etc. One of the most popular and valuable tools to solve network flow problems of a topological nature is the use of integer linear programming models. In this study the feasibility of using a tree knapsack approach to solve a specific oil pipeline network problem is investigated.

Decision support with respect to generator maintenance scheduling in the energy sector

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Abstract

Power generating units operate continuously to provide electricity for a country or region. Due to safety standards, each unit (irrespective of type) has to be shut down for maintenance after a certain number of operating hours. If the different shut-down times for all the power generating units are not properly scheduled, electricity shortfalls may occur, leading to economic losses to industry and considerable frustration on the part of the public. The need therefore exists for decision support as to when a power company should schedule maintenance downtime for its power generating units. Various costs are associated with shutting down a generating unit for maintenance, such as labour, component replacement costs, loss of income, more expensive substitute power generation, etc. One of the objectives in this scheduling problem is therefore to minimise the cost per megawatt of electricity generated, while another is to minimise the risk of a power shortfall by maintaining a pre-specified safety margin in generating capacity. The constraints of the problem include service personnel availability, adherence to the fuel supply levels for each generating unit and most importantly, ensuring that no generating unit operates longer than a specified duration since its last maintenance service. In this talk a short introduction will be given with respect to the energy situation in South Africa. A formulation for the generator maintenance scheduling problem will be given as a mathematical programming model together with a discussion on the impossibility of an exact solution approach. Metaheuristics will be implemented to solve the problem approximately and the results will be presented. The ultimate aim is to implement these metaheuristics into a computerised decision support tool for use by an electricity provider, such as Eskom. This is still work in progress.

Vehicle routing and scheduling optimisation system for the beverage industry in Zimbabwe

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Abstract

This study was concerned with designing a vehicle routing and scheduling system to improve fleet utilization and reduce delivery costs whilst satisfying customer demand for the beverage industry. This was applied at one of the leading beverage companies in Zimbabwe, with our study being centered on the Bulawayo distribution for this beverage company.

An algorithm called the Savings algorithm was adopted to solve the problem. Because the problem was a combinatorial problem, a software was designed to facilitate speed determination of the routes. We then went on to further solve our problem using a commercial software called Fleet logistics optimizer (FLO) which uses another algorithm called the hill climber algorithm. The results from the two software where then compared with those of the from the company's manual routing process by their own company dispatcher. We therefore saw that the routing software had a more cost effective approach to routing than the manual routing approach.

Analysis of inventory using economic order quantity model for fuel company in Zimbabwe

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Abstract

The project deals with keeping track of inventory of diesel and petrol in a local state owned Petroleum Company in Zimbabwe. The main idea is to find the best amount of fuel to be ordered by the company and when to order so as to minimise cost while satisfying demand. The data was collected at one of the company's service station at the company's regional office for two months. Daily and monthly stocks, sales, and losses are provided. The Economic Order Quantity model was used in this project to find the optimal solution. The calculations done provided results that give the procurement manager a general guideline of how to manage the company's inventory.

Improved assignment and routing of care workers for the home and community-based care scenario in South Africa

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Abstract

The HIV/AIDS pandemic has reached an unprecedented scale in South Africa. The burden that this has placed on the country's already restricted health care resources places a greater emphasis on the value of home-based care. Home based care is a service model appropriate to a number of contexts from palliative and elderly care to the support of orphaned and vulnerable children. The problem is exacerbated by factors such as time windows, the necessity of efficient skill and need matching and the wide geographical dispersion of households in impoverished and/or remote South African communities. As far as possible the assignment of beneficiaries to care workers and scheduling of home visits should be done in such a way that the travelling time of the care workers will be minimised. The home-based care problem is addressed by a combination of two optimisation models namely the Nurse Rostering Problem and the Vehicle Routing Problem with Time Windows. The former model determines the optimal assignment of beneficiaries to care workers while the latter minimises the time spent travelling. This presentation will discuss the hybrid approach of the home-based care algorithm, which includes metaheuristics, to address the home-based care problem. Results obtained by the algorithm in a unique South African case will also be presented.

An evaluation of the efficiency of self-organising versus fixed traffic signalling paradigms

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Abstract

Traffic congestion is a major problem in South African cities, resulting in significant costs in terms of man hours lost and excessive fuel consumption, thereby also having an adverse environmental effect. At present, traffic is largely controlled by centralised traffic signals. However, these traffic signals are typically operated according to a fixed red-green time schedule which varies for different periods of the day as a result of the general traffic flows that are specific to those times. Some vehicle actuated techniques have also been introduced, such as electro-magnetic sensors, which can detect a handful of vehicles waiting for service at a signalised intersection. The trouble with such fixed-time schedules is that they are typically too rigid to deal with extreme situations, such as a major accidents or heavy traffic to and from events such as sporting events, concerts, etc. A proposed solution to ease congestion in complex road networks is the implementation of a decentralised self-organising system, which allows the system to discover for itself the most effective traffic signal timings as a function of the current traffic situation and to adjust itself accordingly. Recent developments in technology have seen the introduction of radar systems which, when mounted on traffic lights, effectively allow the traffic light to “see” a certain distance down a stretch of roadway, enabling it to perceive the local traffic state on the road as well as the number of vehicles approaching the intersection and their respective velocities. In this talk various self-organising signaling algorithms and heuristics will be compared in a simulated environment with respect to their minimising propensity of the waiting times of the vehicles in the system. These self-organising techniques will also be compared to currently implement fixed time schedules.

*A mathematical model for the control of *Eldana saccharina* Walker*

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Abstract

Stalk borers are the most damaging type of insects in African and Indian Ocean Island sugarcane plantations. They not only affect the sucrose content of sugarcane, but also the final sugarcane biomass. A recent estimate indicates that during the 2001/2002 milling season, the South African sugar industry lost between R97.4 million and R150 million in revenue due to damage caused by the African stalk borer, it *Eldana saccharina* Walker (Lepidoptera: Pyralidae). The *Eldana* problem is thus of major concern among sugarcane farmers, and a means of effectively managing the pest is the subject of a number of intensive research programmes at the South African Sugar Research Institute. *E.saccharina*, an insect indigenous to Africa that feeds on wild grasses and sedges, and more recently cultivated graminaceous crops, first appeared in the South African sugar industry in the 1940s. It re-appeared in large numbers in the 1970s and since then has spread throughout the sugar industry. The control of *E.saccharina* in sugarcane fields in KwaZulu-Natal remains a serious problem. Among the methods of control currently being investigated as part of the area-wide integrated pest management program, is the sterile insect technique. This technique involves rearing large numbers of the target pest species, exposing them to gamma rays in order to induce sexual sterility, and then releasing them into the target population to reduce reproduction. In order to aid the research currently being carried out, a mathematical model of *E.saccharina* population growth and interaction with the sterile insects has been formulated. The model is cohort-based and includes the effects of temperature on maturation and mortality in the various life-stages of the insect. In order to investigate the effects of migration, a spatial model has also been formulated by adopting a metapopulation modelling approach. These models as well as some preliminary numerical results obtained via the models will be presented in this talk.

Coastal threat evaluation decision support

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Abstract

The policing and monitoring of South Africa's 3,924km coastline and 1.5 million square kilometre maritime economic exclusion zone (EEZ) is made difficult not only by the size of the area of interest, but also by the limited resources available for detection and policing. As a consequence, illegal activities such as smuggling, poaching and illegal border crossings, are often conducted with impunity. Research is currently being conducted by the CSIR into a persistent ubiquitous surveillance system capable of providing real-time situational awareness. Using data collected from sensors within such a system, a contribution may be made to coastal safety and security through the analysis of the spatio-temporal patterns of observed sea vessel activities so as to predict future behaviour and detect illegal activities. A solution to this problem is sought in the domain of pattern recognition where pertinent features that reliably characterise vessel trajectories are used to classify novel trajectories as exhibiting either anomalous, illegal or normal behaviour. Successful classification and timely prediction of behaviour would allow for effective policing by providing early warning to relevant entities, such as the coast guard.

Communicable disease disaster management

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Abstract

Outbreaks of communicable diseases in the African context are considered disasters. As such, disaster management protocols and methodologies are applied to combat communicable diseases and the resulting consequences. Outbreaks escalate into epidemics and the prediction of outbreaks and epidemics is near impossible. However, it is possible to monitor outbreaks and the associated spread patterns. The intelligence gained can be used for proactive decision making that will facilitate the expedient execution of retrospective disaster management activities.

An interactive simulation of outbreaks and the disease transmission that will lead to epidemics was developed. The simulation was focused on two diseases namely H1N1 (Swine-flu) and Measles within the City of Johannesburg municipal area. Insight gleaned from this simulation would facilitate proactive decision making in the area and inform future simulation based epidemiology studies. Mathematical epidemiology and Agent Based Modelling (ABM) are two techniques that in combination are expected to produce a realistic simulation. Mathematical epidemiology is the application of mathematics and related concepts in the study of disease. Compartmental epidemiology is a subset of mathematical epidemiology where individuals of the concerned population or location are grouped into one of three groups. Each group or compartment has one of the following states assigned to it and all its occupants: Susceptible, Infected and Recovered. Measles and H1N1 both have a Susceptible Infected Recovered (SIR) compartmental infectious disease models. When exploring the SIR model in a stochastic context, a Markov Chain is an applicable tool to enable the modelling of inter-state transition of an individual within a population. ABM is used to study complex systems and to convey how macro phenomena emerge from micro level behaviour and interactions between agents in an environment. An epidemic (macro phenomenon) is the consequence of many lower level individual infections and the associated disease transmission (micro phenomena). Compartmental epidemiology is thus used to demonstrate disease transmission while ABM will be the interface that enables simulation of the interaction of humans within a population or environment.

Aiding decision making in allocation at FoodbankSA

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Abstract

There is a wealth of literature pertaining to the application of hard OR techniques (simulation, linear programming, goal programming) in determining optimal ordering, inventory and allocation policies within developed economies. In contrast, there is a dearth of research relating to similar applications in developing economies, or more particularly in the unique context of a developing country. This study aims to assist decision making at a not-for-profit organization, Foodbank South Africa, regarding its allocation system through a combined 'soft-hard' OR approach. Two problem-structuring tools (soft OR), causal mapping and Soft System Methodology's (SSM) CATWOE analysis are used to structure the organization with respect to its goals, in order to gain a comprehensive understanding of the decision-context in which decisions are made. A simulation approach (hard OR) is applied to the daily operations at the Cape Town warehouse (Foodbank Cape Town), wherein 'decision-rules' (expressed as algebraic equations with built-in variable parameters in the model), related to allocation, that are utilized by floor managers are simulated on a daily basis over a fixed period of time. The simulation model is run iteratively, and optimized with respect to each of the built-in parameters. The resulting set of optimal allocation decisions or 'policy' is then used as input into the next simulation run, from which a new allocation policy is formed. The predicted output of the simulation model is a range of optimum allocation policies that could be utilized. A decision support tool will be developed that will automate allocation decisions, depending on the particular allocation policy adopted.

Application of graph theory in matching problems

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Abstract

In this paper, we consider the application of graph theory to problems in operations research. We start by considering the general theory relating to graph theory and networking and then consider in detail bipartite graphs which are special types of graphs in which a set of vertices can be divided into two disjoint subsets, such that each edge connects a vertex from one set to a vertex from another set. We then consider matching problems which arise in numerous applications which include dating services who want to pair up compatible couples. In matching problems, our goal is to create maximum number of compatible pairs. This leads us to the matching algorithm commonly known as the Hungarian algorithm. We note that the matching problems arise in everyday life and the ability to understand and solve them would help us in coming up with solutions to everyday problems.

Games on networks

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Abstract

The presence of cooperation in a society with selfish agents has for a long time intrigued social scientists and game theorists alike. The prisoner's dilemma (PD) is the archetypal game often employed to study cooperation. An important question is: Under which circumstances is cooperation possible among players in the PD? In fact, cooperation in the PD is quite hard, and very specific conditions are required to facilitate cooperation. One way of facilitating cooperation may be achieved by placing agents in spatial arrangements and allowing only nearest neighbour agent interaction. The incorporation of a spatial topology was first introduced into games by means of lattices. PD games on lattices exhibit complex and interesting dynamics. Beautiful Persian carpet-like patterns can emerge and interesting phase transition properties are often witnessed. Given the right parameter values, cooperators are able to "invade" defectors. But the key to such success lies in teamwork. By organising themselves into clusters, cooperators can gain a higher pay-off than isolated defectors. However, a lattice is just one structure which may be used to incorporate a spatial aspect into games. We also seek to understand game dynamics over more general topologies. The PD has been applied widely to study problems in economics, evolutionary biology and social sciences. Social networks, company structures and shipping routes are but a few examples of networks which may host PD-type games.

Operations research: A cornerstone for freight transport energy management

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Abstract

The need to conserve resources, improve sustainability and protect the environment is recognised globally. The transport industry is in great need of sustainability engineering, as it is presently 97% dependent on fossil fuels as energy source and it is a significant contributor to greenhouse gas emissions world-wide. Although a plethora of individual transport energy mitigation measures have been proposed and researched, very little research informs on the combination of measures into transport energy management strategies. Decision makers require reliable guidance on the optimal combination of measures, taking into account their different perspectives and respective situations. Operations research tools, such as pareto simulated annealing, are well-suited to provide sensible, scientifically sound information on which strategic energy management decisions can be based. This paper highlights the contribution that the employment of operations research techniques can make to the field of freight transport energy management. A needs assessment is done to develop a specification for the information output typically required. This is combined with a review of the typical input data available in order to identify and discuss suitable operations research techniques that can be employed in a freight transport energy management decision support model.

Decision support for evaluating electricity saving options

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Abstract

Reducing the electricity consumed by households is considered to be an important aim of local government. Much information has been collected on the expected capital costs, electricity savings, and behavioural changes required by various reduction strategies. The aim of this application is to show how a simple inverse-preference model can use this information to provide useful additional decision support, "useful" in this context meaning able to identify promising strategies, provide information about the types of preferences that might lead to the selection of different strategies, and explore the impact on results of any uncertainty in the evaluations.

Finding the optimal cutting patterns for N identical two-dimensional stock sheets

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Abstract

The typical cutting stock problem is considered as encountered in a glass cutting shop. That is, an order must be satisfied by cutting the ordered pieces from stock sheets. The stock sheets to be used are considered to be identical. This is the typical (two dimensional) single stock-size cutting stock problem (2DSSSCSP). The optimal cutting pattern for a single sheet can be established by means of the algorithm of Wang or extensions thereof for the so-called trim-loss problem. Wang uses a beta to define a percentage of the stock sheet size. All possible patterns are considered in an orderly way and those with waste exceeding the percentage are discarded and not considered further. Different percentages are considered and when beta equals one, it implies that all possible patterns are to be formed (this may be computationally very expensive). In this paper this idea is generalized to the case where the number of stock sheets (N) is larger than 1. Thus for a specified N , a given set of demand items and a given stock size, we can establish the optimal set of cutting patterns for the N sheets without necessarily generating all possible patterns (thus beta is restricted).

Investigating some heuristic solutions for the two-dimensional cutting stock problem

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Abstract

In this study, the two-dimensional cutting stock problem is considered. This is a problem that occurs in the cutting of a number of rectangular pieces from a single large rectangle. A heuristic procedure is developed to solve the two-dimensional single stock-size cutting stock problem (2DSSSCSP). The major objective is to minimize waste and the number of stock sheets utilized. The heuristic procedure developed to solve the two-dimensional single stock-size cutting stock problem is based on cutting pattern generation. A combinatoric process is applied to generate a set of cutting patterns using the Wang algorithm and a commercial software package CUTLOGIC 2D. The generated cutting patterns are used to formulate an integer programming model. Empirical experimentation is done to test the heuristic procedure using data obtained from both small problem instances found in the literature and larger real world application problem instances. The results obtained show that the heuristic procedure developed produces good results for both small and real life problem instances.

A method of detection and correction for outliers in time series data

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Abstract

Outlier detection has become an important part of time series analysis and influences modeling, testing and inference, because outliers can lead to model misspecification, biased parameter estimation, poor forecasts and inappropriate decomposition of series. A method to detect and correct for outliers in time series data is proposed. It is based on using the Gumbel distribution as a limiting distribution for outliers. It is on this basis that we come up with an algorithm of determining when an observation can be classified as an outlier. The method is then applied to some residuals of Autoregressive Integrated Moving Average (ARIMA) models fitted to Zimbabwe Stock Exchange Industrial Indices and if any outliers are detected a correction procedure is then applied to rid the data of the outliers. A new model is then fitted to the corrected data series and some analysis. The results show that the method is effective in detecting outliers and the correction procedure ensures that the correct model for the data is specified and the parameter estimates are unbiased.

Investigating the effects of different grazing ratios and stocking rate of cattle and goats under mixed species grazing on different plant species

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Abstract

The study focuses on investigating the effects of different grazing ratios and stocking rate of cattle and goats under mixed species grazing on different species of plant. The experimental site was Matopos Research Station (Matobo district, Zimbabwe). This study is confined to the commonest grass species and forbs in the experimental site. Data for the herbaceous and browse biomass weight per hectare was collected for a period of eight years. Data for the individual plants was collected for a period of 9 years. Annual rainfall was recorded in the experimental site. Generally, heavy goats stocking rate resulted in low productivity of browse biomass while heavy cattle stocking rate resulted in low herbaceous biomass productivity. The inverse relationship is also true for light stocking rate of both animal species. There was no evidence of a significant linear relationship between annual rainfall and herbaceous biomass productivity in all treatments at 5% level of significance. However, there was overwhelming evidence of a strong quadratic relationship between annual rainfall and herbaceous biomass productivity with the proportion of variability in herbaceous biomass productivity attributed to rainfall ranging from 95 to 99% in all the treatments. It is concluded that different grazing ratios and stocking rate of cattle and goats (treatments), year and their interaction have effects on the productivity of several plant species. The quadratic relationship between annual rainfall and biomass productivity indicates that there are several factors in addition to annual rainfall that account for biomass productivity. Recommendations are made regarding the practice of mixed species grazing and the optimum number of cattle and goats per given rangeland.

Facility location for FoodBank Cape Town

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Abstract

FoodBank South Africa is a non-profit organisation formed to establish a nationwide network of community foodbanks in urban and rural areas of the South Africa, with all participants working towards the common goal of eliminating hunger and food insecurity. FoodBank Cape Town (FBCT) was the first of these community foodbanks launched in South Africa on 2 March 2009. The operations of FBCT include sourcing food and redistributing this food to agencies (social services organisations running feeding programmes). Currently the majority of the food is sourced from the retail sector and distribution centres, and the food is then redistributed to approximately 300 agencies to which FBCT supply. The logistics involved in both sourcing and distributing food are vital to the functioning of FBCT. Since the costs associated with these logistic operations are very high, streamlining these operations has therefore been identified as a priority area for efficiency improvement. In this presentation we look at progress on improving the efficiency of FBCT's logistical setup, focusing on the distribution of food to agencies. In particular we present a facility location model which may be used to find good locations for local distribution depots. The implementation of the model and results achieved are reviewed, together with some recommendations to FBCT in terms of the location of their distribution depots.

Tools & methodology for high level military decision analysis

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Abstract

This presentation will illustrate the issues regarding Decision Making in the Military and the added issue of High Level or Strategic Decision Analysis. The nature of decisions needed at high levels are not necessarily appropriate for the application of traditional “hard” OR methods. The availability of data at those levels is often not good. In a Military environment personal (or Service) interests may overpower logic in high ranking individuals. A number of aspects will be discussed. Such as: The problem of deep uncertainty. Is it possible to reconcile analytic and intuitive considerations in formal decision-making? The influence of systems methodology on the level of decision making can aid understanding. Possible methods or approaches that are effective and/or possible will be discussed.

Scalable solutions in OR: An application in waste collection and transportation

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Abstract

During 2009 and 2010 the CSIR undertook a project to develop optimisation algorithms capable of generating collection routes for waste collection vehicles. In order to help municipalities reduce their operational cost and deliver a sustainable waste collection service, the optimisation studies in waste collection routing need to be complimented and integrated with similar studies into tactical and strategic waste collection decisions. Strategic decisions affect tactical decisions, which in turn affect operational decisions. For instance, a new landfill close to the collection area will affect the area's transfer station location, which will then affect the routes that the collection vehicles follow. To make an informed decision a decision maker can not exclusively focus on one domain, such as vehicle routing. The decision maker needs to predict and analyse the cascading impact and interdependencies of decisions between all three domains (strategic, tactical and operational). Hence it is critical to predict the impact of a strategic decision on an operational level

In this presentation we will show how modular optimisation algorithms developed for operational support, specifically collection route design, can be extended and integrated to provide strategic decision support to municipalities. The optimisation algorithms are integrated into three strategic algorithms whose aim is: to determine the type and number of collection vehicles required to service a municipal are; to sector a service area into balanced collection days and vehicle areas; and to determine the location of transfer stations within a collection area. Since the three strategic algorithms are again modular, the three are integrated into a meta-model capable of providing holistic decision support to municipalities.

Modelling supply chain risks in agile supply chains

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Abstract

In this paper, a model for agility of supply chains is presented. Furthermore, it is observed that in the quest for agility, supply chains expose themselves to various risks. These risks are identified in terms of source, impact and likelihood of occurrence. A model for mitigation is proposed, and an illustrative example presented on the application of these mitigation strategies

Residential waste management in South Africa: Optimisation of vehicle fleet size and composition

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Abstract

The collection of residential waste is a highly discernible and essential municipal service that involves large expenditures. In this presentation we focus on transportation costs: the cost of operating and maintaining the vehicle fleet, as well as the capital costs of acquiring additions to the vehicle fleet. Additions include both vehicles to be purchased and possibly vehicles to be hired. Each vehicle class may be constrained from traversing or servicing certain street segments due to limitations such as physical dimensions. The basic nature of our problem is that of a Capacitated Arc Routing Problem with Vehicle Site Dependencies. We present a Vehicle Decomposition Algorithm capable of determining the collection routes and the vehicle fleet size and composition for a fleet of waste collection vehicles with the objective of minimising the total cost incurred. Computational results for benchmark problems are provided.

Directed cyclical picking line optimization Part II: Algorithms, preliminary results and future work

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Abstract

Building on Part I: Industry background and introduction, this presentation will focus on solution techniques for some subproblems and ideas for future work. The sequence in which individual branch orders are picked within the picking line must be optimised in order to reduce unnecessary picker travelling. This problem is known as the branch order sequencing problem. Exact solution approaches as well as heuristic and metaheuristic methods for this problem are presented. Bounds for solutions to the branch order sequencing problem within picking line optimisation are considered. It was found that the solution may be bounded to within 1 cycle of a lower bound by making use of a mixed integer programming formulation. Current approaches to the problem of assigning SKUs to particular bay locations within a picking line in order to reduce travel distances are discussed. The case where a SKU may be duplicated and allocated to two bay locations is also discussed with solution methods including heuristic, metaheuristic and clustering algorithms. Some preliminary results and a brief discussion on potential future solution methods are presented. Finally, potential solution methods for the problem of assigning SKUs to picking lines as well as the problem of selecting SKUs to be duplicated on a picking line will be discussed.

A tabu-search for minimising the carry-over effects value of a round-robin tournament

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Abstract

A player in a round-robin sports tournament receives a *carry-over effect* from another player if some third player opposes the first player in some round and the second player in the next round. The *carry-over effects value* of a round robin tournament may be obtained by taking the variance of the number of carry-over effects given by some player to all other players, and taking the sum of this variance over all players. In order for the tournament to be fair, the objective is to find a round-robin tournament that minimises the carry-over effects value. A strict lower bound on the carry-over effects value of a round-robin tournament of order n is $n(n-1)$ (in which case there exists a round-robin tournament of order n such that each player receives a carry-over effect from each other player exactly once), and it is known that this bound is sharp where n is a power of two and where $n=20,22$. It is also known that round-robin tournaments can be constructed from so-called *starters*, and round-robin tournaments constructed in this way are called *cyclic*. It has been previously shown that cyclic round-robin tournaments have the potential to admit small carry-over effects values, and in this paper we use a tabu-search for finding starters which produce cyclic tournaments with small carry-over effects values. We validate the best solutions found so far for orders up to and including 22, and find new upper bounds on the carry-over effects value for orders larger than 22 up to and including 40.

Inventory management under uncertainty – An application

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Abstract

Inventory management under uncertainty is a widely researched field and many different types of inventory models have been used to address inventory problems in practice. However, there is a need to focus on inventory management in environments characterised by uncertainty as a result of extreme events. In this presentation a decision support model for inventory management the military - an environment characterised by extreme uncertainty - is discussed. The model attempts to minimise the total cost, total number of shortages and the overall surplus stock quantity using goal programming, while incorporating demand uncertainty by means of probability distributions and fuzzy numbers. The model takes different possible future scenarios into account and determines the minimum required stock level for different stock categories, for a single item, in each of the three scenarios. The model is converted into its crisp, non-fuzzy, and deterministic equivalent by firstly transforming the fuzzy constraints into their crisp equivalents and then deriving the deterministic equivalent of the crisp stochastic model. The crisp, deterministic equivalent model is then solved using exact branch-and-bound embedded in the LINGO 10.0 optimisation software package and the reliability of the results in different scenarios tested using simulation.

Directed cyclical picking line optimization - Part I: Industry background and introduction

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Abstract

Order picking is one of the slowest, most labour-intensive and costly activities for the majority of distribution centres. Pep Stores Ltd. (PEP) has identified a bottleneck in their supply chain to be their picking lines within the distribution centres. PEP currently uses a picking line system to fulfil branch orders from its various retail outlets and wants to improve the efficiency of the picking line system, i.e. to pick all branch orders in a shorter time. Currently the picking lines as well as the operations of the picking lines are not optimised to improve the pick rate. The operations of the picking lines may be divided into three distinct interlinked problems. The first problem entails the decision of which products should be allocated to which picking lines. It is a process of grouping stock-keeping-units (SKUs) with similar characteristics and sending those products to the same picking line. The second problem considers the assignment of the SKUs in a picking line to bay locations. SKUs should be assigned to bays such that the distance travelled by the pickers within all orders is minimised. The final subproblem requires an optimal sequencing of the branch orders within a picking line as to minimise the total distance travelled by the pickers between orders. An industry background is presented of the manner in which PEP operates its picking lines currently. The constraints associated with the regulations imposed by PEP are discussed. These regulations render optimisation techniques found in literature to be ineffective or unsuited for operations within PEP. Part II will focus on solution techniques for subproblems and ideas for future work.

Daily electricity demand forecasting in South Africa

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Abstract

South Africa experienced a crisis that resulted in severe electricity blackouts at the beginning of 2008. Both domestic and industrial electricity users countrywide suffered from this crisis. It is argued that one of the reasons was lack of research on energy in South Africa. However, Eskom argues that lack of capacity can only be solved by building new power plants. Electricity demand forecasts are important for electricity companies to plan and dispatch electric loading so as to meet system demand. This is because electricity demand has grown at a rapid rate over the past decade. This study discusses and presents the results of utilizing time series regression models to forecast daily electricity demand in South Africa.

Analysis of the common causes of human deaths in Limpopo Province

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Abstract

The study analyses the common causes of human deaths in Limpopo Province. The main aim of the study is to determine the association between the causes of deaths in the Limpopo Province, by age and sex. The two causes of human deaths, natural and non-natural causes are considered in this study. The data is extracted from Statistics South Africa's Mortality and causes of death from death notification, 2006. The linear and logit probability models are used to determine the relationship between the causes of deaths and age. The likelihood-ratio test of homogeneity is applied to check whether or not the two population groups are dying of the same cause of deaths.

The effect of unemployment on crime among young South Africans

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Abstract

This paper presents the effect of unemployment on crime among youth in South Africa as one of the developing countries in the world. Unemployment is one of the socio-economic challenges the world is facing today. There are economic explanations for the expected positive relationship between unemployment and crime, as unemployment may result in an individual resorting to criminal activities. The study explores the relationship between unemployment and crime in South Africa by focusing on the economic reasons as well as the classification of unemployment and sources of the problems that lead to crime. In addition, a discussion is made on the private and social cost of unemployment which emphasis on the behavior of the young labour force. The paper provides suggestions on how unemployment and crime can be reduced through different macroeconomic policies and government programmes.

Key words: crime, unemployment, labour force and macroeconomic policies.

Electricity generated and available for distribution in South Africa

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Abstract

This study estimates the monthly future values of total volume of electricity available for distribution by employing time series models. Secondary data from Statistics South Africa's publication is used in the study. In this context, time series method is applied for medium-term forecasting for future series of electricity consumption. Several methods such as moving average were used to produce quality results. The findings of this study could be used to compile estimates of the gross domestic product (GDP) and its components, which are used in monitoring the South African economy and policies.

A comparison of Grade 12 pass rates between the old and the new curriculum in Limpopo

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Abstract

This study is aimed at comparing Grade 12 learners' overall pass rates between the old and the new curriculum among grade 12 learners in the five districts of the Limpopo Province. Analysis of variance (ANOVA) is used to compare the pass rates from 2006 to 2009. The objective of the study is to determine if there are any differences in the performances of the learners in the five districts of the province. The study uses administrative data provided by the Limpopo provincial Department of Education.

Analysis of the inflation rate of alcoholic beverages

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Abstract

This paper presents an analysis of the inflation rate of alcoholic beverages in South Africa using the secondary data obtained from Statistics South Africa for the period 2002 to 2010. The time series method will be used to analyse the data. The study aims at developing a forecasting model that will help to forecast the inflation rate of alcoholic beverages in South Africa. An ARIMA model was developed and the results indicate that inflation is on the rise in South Africa. This study plays a significant role in creating an awareness of the effects of high inflation on the general public and the economy of South Africa.

Key words and phrases: Alcoholic beverages, high inflation, ARIMA.

The effect of high electricity consumption on the South African economy

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Abstract

The availability of electricity is not a solution for social and economic problems that South Africa is facing; it could be the solution for social and economic development. This paper aims to make a detailed analysis of the relationship between the economic growth and electricity consumption for the period 1996 – 2009. Box – Jenkins method (1976) is used to develop a predictive model for electricity based on the economic growth; and regression analysis is used to obtain the correlation as well as the long term relationship between the two variables. The results of the study indicate that electricity usage has increased at a very high rate from 1996 to 2009. This is evidenced by the power blackout that was due to high electricity demand which Eskom was unable to meet.

Kew words: economic growth, electricity consumption, regression analysis, Box–Jenkins

Analysis of poverty in South Africa

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Abstract

Upon South Africa joining the democratic world in 1994, a lot of policy frameworks were introduced, the most important of which was a commitment to alleviate poverty. In this study we investigate whether or not the South African government is winning the battle on poverty reduction using the Community Survey conducted by Statistics South Africa in February 2007. Various poverty measures that are analyzed include geography, education, unemployment, income and access to services.

A logistic regression analysis of the occurrence of mine accidents in the Burgersfort area in South Africa

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Abstract

In this paper a logistic regression model is developed and used to predict the probability of accidents occurring in mines and to estimate the occurrence of accidents due to machines and falling rocks. We designed a questionnaire and conducted interviews among workers in the mines of Burgersfort area in the Limpopo Province in South Africa. A total of 372 people responded of which 29% were accident victims. From the primary data that was collected, the independent variables were accident victims due to machines and accident victims due to falling rocks. These independent variables were significant to enter the model to predict the occurrence of accidents in the mines. Our results show that most accidents in the mines occur due to conduct with machines and falling rocks. The paper also indicates that falling rocks in the mines is the most cause of accidents. Awareness campaign programs should be carried out so as to educate miners on the major causes of accidents in the mines and how to prevent them.

Key words: logistic regression, mine accidents, safety, falling rocks.

Forecasting monthly production of gold in South Africa

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Abstract

In this paper we develop short term forecasting models for predicting gold production in South Africa. Classical time series methods are used together with GARCH type models. We present preliminary results of our study including a comparative analysis of the methods used.

Key words: GARCH, ARIMA, gold production, volatility.

An analysis of number of the vehicles and pedestrian involved in fatal crashes: Limpopo province, South Africa

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Abstract

Time series analysis was applied to the number of vehicles and pedestrians involved in fatalities in Limpopo. The data for the number and type of vehicle involved in fatal crashes was collected from 2001 until 2008 and the number of pedestrian casualties was collected between the year 1999 and 2002 recorded over time and time of the day. Box-Jenkins method was applied to choose the model that adequately represents the data or stationary time series. ARIMA (0,0,2) was found to be a good model to estimate the number of vehicles involved in fatal crashes, ARIMA (1,0,2) for fatalities per type of vehicle and ARIMA(0,1,2)x(1,0,0)⁷ for the number of pedestrian casualties.

Diagnostic analysis of a Saturday school

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Abstract

As part of South Africa's single largest BBBEE equity transaction to date, 1.5% of Sasol's shares was allocated to the Sasol Inzalo Foundation. This foundation was established to make a significant contribution to sustainable economic growth in South Africa by focusing on skills development and capacity building amongst historically disadvantaged communities primarily in the areas of mathematics, science, engineering and technology. To be a significant contributor, the Foundation must make a noticeable difference by building both the quality and quantity of the intellectual capital for South Africa. To diagnostically analyse one aspect, namely matric passes, entrance into university and success at university, the Foundation adopted a Saturday School. The Foundation acknowledges that cause and effect might not be close in space or time and that the bigger whole might be more than the sum of the smaller parts. Hence the Cynefin framework [1] is utilised to sort the issues facing the Saturday school into five contexts namely simple, complicated, complex, chaotic and disorder. In this paper I discuss the diagnostic analysis process as well as the learnings from it.

[1] SNOWDEN DJ & BOONE ME, 2007, *A leader's framework for decision making*, Harvard Business Review, November, pp. 1-8.

Income tax prediction when tax avoidance matter

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Abstract

The study examines how tax avoidance in the form of income tax return affects the empirical study of tax revenue. The implications for tax policy analysis are discussed, and it shown that a failure to account for avoidance responses may lead to huge errors when predicting income tax return affects tax revenue, and the welfare cost of taxation. In conclusion, decision tree analysis is used to explain a number of otherwise hard to understand dimensions of tax payer response

Tactical sugarcane harvest scheduling

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Abstract

Abstract. In his talk a novel decision support system (DSS) for tactical harvest scheduling will be described. Sugarcane growth and recoverable value are modelled using multiple regression on readily available historical data, while novel deterioration and penalty models account for environmental events and strategic decisions which may affect the quality of a sugarcane harvesting schedule. These models are incorporated as a building block in the DSS. The tactical harvest scheduling problem is modelled by a mathematical programming model formulation that incorporates time-dependency, the problem being closely related to a time-dependent travelling salesman problem. Solutions are uncovered by means of an attribute-based tabu search algorithm which was coded together with the earlier mentioned building block in addition to a database for information and a user interface into a decision support system using Microsoft's Excel. The decision support system was developed during two sugarcane harvesting seasons and several sugarcane growers provided frequent evaluation and realtime data during the entire 2009 season and the early 2010 season in order to validate the system.

Operations research in transportation of goods and services

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Abstract

The aim of the project is to design a routing and scheduling system for a company, present major stages applicable to building effective models and routes that are cost effective. Procedures involved will be to identify the problem at the company, come up with a mathematical model solve the problem apply some routing software and then analyze the results.

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